DIY

Worthwhile projects you can build on your own

The inverted-L Rybakov 806 antenna

The what? I've been looking for a good inverted-L antenna design that I could build, and happened upon this version, which seems to have not only operator testimonials but technical data to support them. An inverted-L antenna is simply a vertical monopole (and therefore end-fed) antenna that's bent over somewhere near the middle, so that the bent-over part is at a right angle with the vertical portion and horizontal with the Earth. The advantage of an inverted-L is the ability to support 80 meters using a vertical orientation (complete with a low take-off angle) without being forced to make it stand 60 feet straight up.

This particular design is patterned after one by Craig La Barge WB3GCK and called "Rybakov" meaning "fisherman" in Russian, and named that because it resembles an operator who's fishing for contacts, and in fact can be erected by a common fiberglass fishing pole for the vertical portion. The "806" designation simply refers to the fact that it supports 80 meters through 6 meters, which I'm hoping to prove.

Your coax connects to a 4:1 unun of an alternate design from the one I've showcased in another article. The other side of the unun is attached to the radiating element, which runs straight upward for 26 feet, then straight outward for 27 feet. Because it's an end-fed antenna, it's heavily dependent on a good ground connection for its performance and matching close to around 200 ohms. The unun then transforms the impedance down to 200 ÷ 4 = 50 ohms for most frequencies, and your internal tuner can handle the rest.

Parts list

One toroidal T-200-2 ferrite core

56 feet 14 AWG stranded wire

One 4.7″ x 3.2″ x 2.6″ enclosure

Four 14 AWG #8 stud ring terminals

Six inches of RG-8X coaxial cable

Two #8 screws, wing nuts, washers, split washers

Two dogbone insulators

One ground lug

One SO-239 bulkhead connector

42 inches of 22 AWG zip wire

One 1-½″ x 3/16″ eye bolt

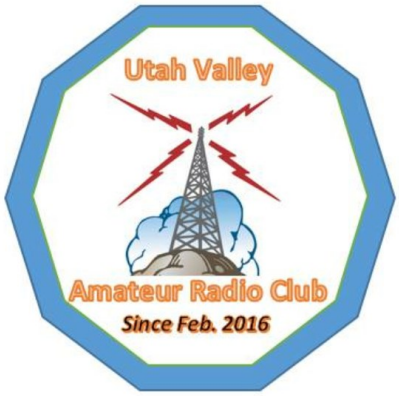
One 14 AWG #4 stud ring terminal

Four each M3 screws, split washers, nuts

One 2-½″ x 2-½″ fiberglass screen

Zip ties, Super Glue™, heat shrink tubing

One 28-foot telescoping fiberglass pole

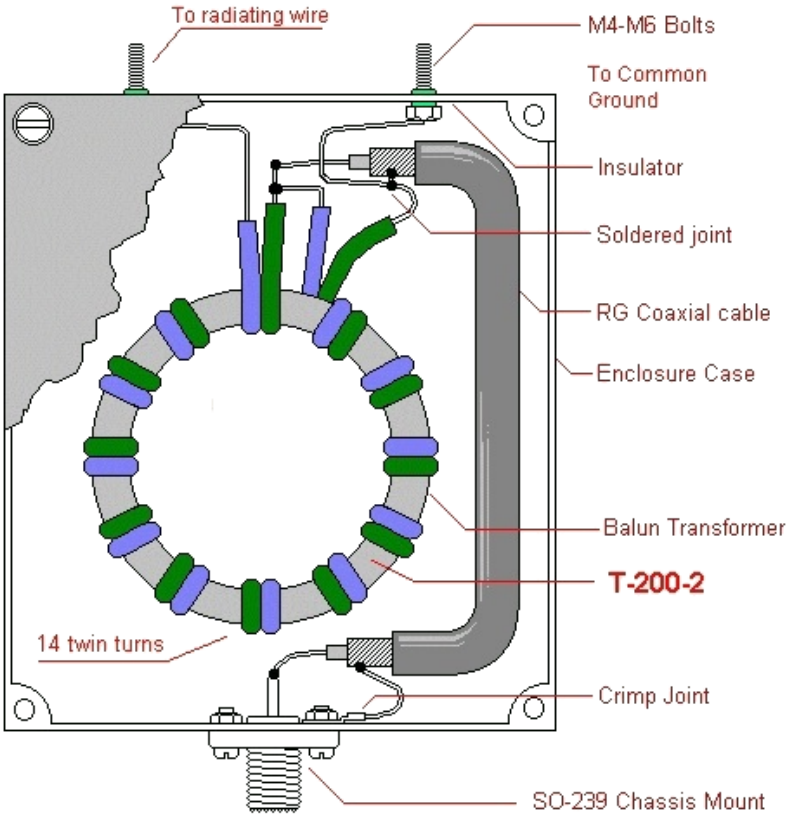


DIY, continued

Inverted-L Rybakov antenna

Coil assembly

The diagram to the right shows what we're trying to accomplish. The purposes of this design are to a) maximize common-mode current reduction, b) minimize losses, while c) maintaining a 50-ohm impedance transformation on the transceiver side of the unun d) for a wide range of frequencies e) on 100 watts of transmit power.

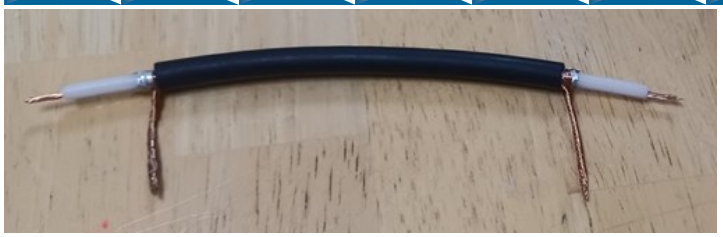


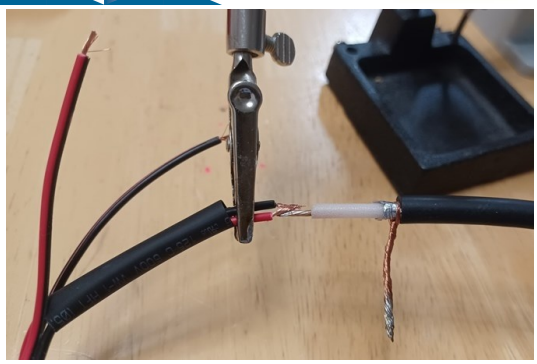
Tightly wrap 14 to 18 evenly spaced turns of the 22 AWG zip wire around the toroidal core, leaving about four inches extra on each end. For reference, our red wire corresponds to the blue wire in the diagram, and our black wire to the green. Secure both ends against the toroid with zip ties, then strip all four wires. Also strip both ends of the six-inch RG-8X coax, making sure to leave enough dielectric (clear) insulation to keep about an inch of separation between the center conductor and the braid on each end.

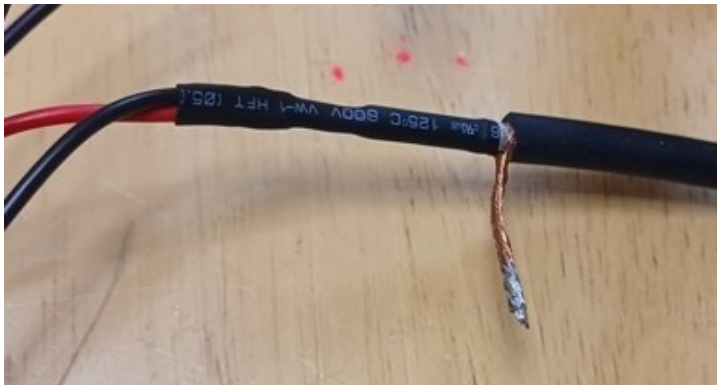
Slip a piece of heat shrink tubing over the black wire on the left side and the red wire on the other side, then solder the two wires together with the center conductor of the antenna end of the six-inch coax. Apply the heat shrink tubing over the junction. Slip another piece of heat shrink tubing over the coax braid, then solder the black wire and the coax braid onto a #8 ring terminal. Apply the

DIY, continued

Inverted-L Rybakov antenna

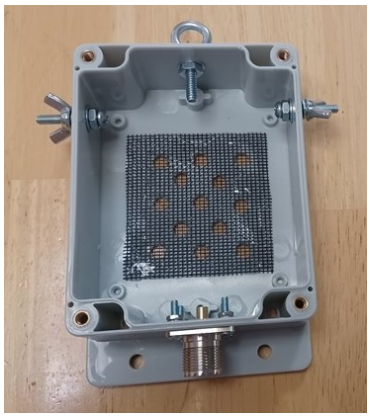






heat shrink tubing over the braid. Solder the red wire to another #8 ring terminal. Solder the coax braid of the transceiver end to a #4 ring terminal.

Enclosure assembly



Drill a 9/16″ hole in the enclosure at one end I'll call the unun bottom. Place the solder cup end of the SO-239 bulkhead into the 9/16″ hole on the outside of the enclosure, and using the four mounting holes of the bulkhead as a template, drill a 1/8″ hole for each mounting hole. Assemble the bulkhead onto the enclosure using the M3-0.5 mm hardware.

Drill eleven to fourteen ¼″ holes in the back of the enclosure, for ventilation. Cover the holes by super-gluing the fiberglass screen over them on the inside, to prevent insects and debris from entering the enclosure.

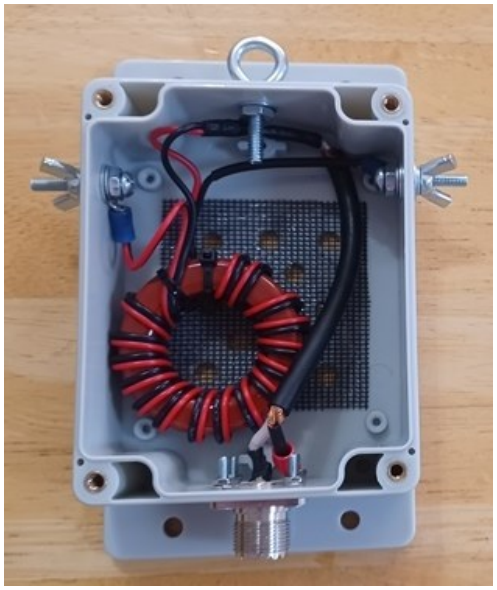
DIY, continued

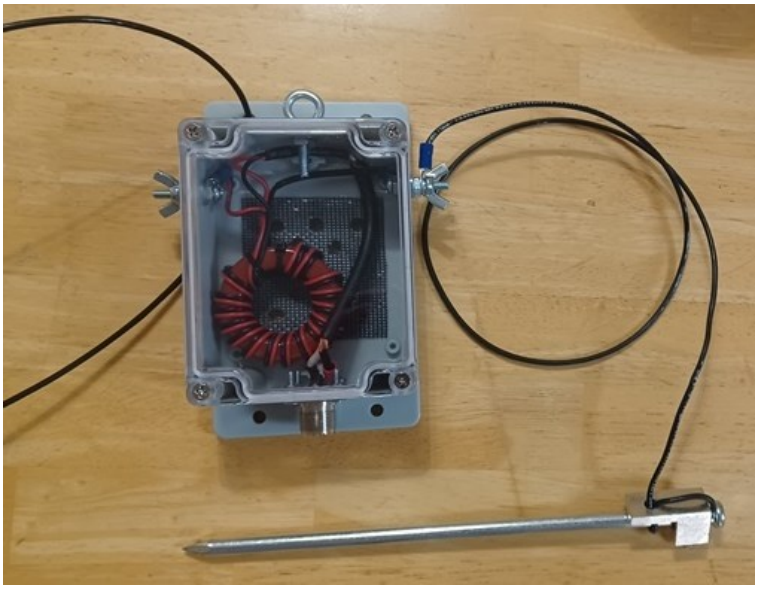
Inverted-L Rybakov antenna

Drill a 3/16″ hole in the unun top, about ¾″ from the back of the enclosure. Install a flat washer onto a 3/16″ eyebolt, and slip the eyebolt assembly through the hole. Secure the eyebolt with another flat washer and a nut. This eyebolt can be used to hang the unun and relieve some of the strain on the wire elements due to the weight of the unun and the coax.

Drill two 3/16″ holes on opposite sides of the enclosure about an inch below the unun top (the end opposite that of the bulkhead connector) and about 1″ from the back of the enclosure. Slip a #8 machine screw through each ring terminal, then tighten a nut onto the screw to hold the terminal in place. Slip each the assembly through the side hole from the inside of the enclosure. On the outside of each assembly, apply another flat washer, lock washer, and wing nut.

Plug a PL-259 connector into the SO-239 bulkhead, for a heat sink. If you don't plug in a connector, soldering the cup in the rear of the bulkhead can get hot enough to melt the dielectric, especially if you're using a low-wattage (under 60 watts) soldering iron. Slip a piece of heat shrink tubing over the unfinished end of the six-inch coax center conductor, solder the center conductor to the center post of the SO-239 bulkhead connector, then apply the heat shrink tubing. Bolt the #4 ring terminal of the braid to one of the M3-0.5 screws of the bulkhead.





Secure the coil to the inside of the enclosure, if you'd like. Install the enclosure cover, and the unun construction is complete.

Grounding, wiring, and counterpoise

Attach a 12-to-30-inch wire to the ground (right, in our case) side by a ring terminal. Connect the other end to a ground stake by a ground lug like this: Strip that end about ¾″ long, and tin the end. Unscrew the ground lug and insert the ground stake into the large hole, with the lug flange pointing away from the stake head. Insert the tinned wire into the mounting hole on the side away from the stake, route the wire around the stake and back out the mounting

DIY, continued

Inverted-L Rybakov antenna

hole, then insert the tinned wire into the same large hole behind the stake, opposite the large screw. Tighten the screw, and the stake and tinned ground wire will be bonded together.

Attach 53 feet of 14 AWG stranded wire to the antenna (left) side. I used #8 ring terminals for both wires, leaving a couple of inches for a strain relief on each of them. Slide a dogbone insulator onto the 53-foot wire, and bend the wire at 26 feet from the unun, and temporarily secure the insulator at that spot, which will be the "elbow" of the upside-down "L" in the antenna. Slide another dogbone insulator onto the 53-foot wire, and secure it at 27 feet after the first insulator.

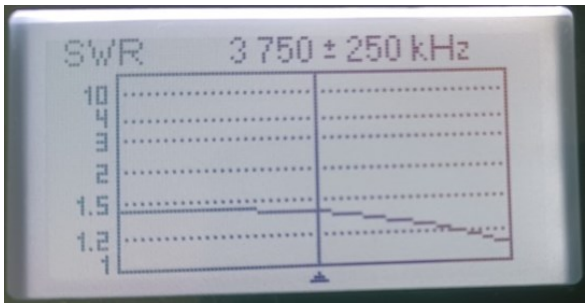
Ground lug and stake and wire detail

Testing the antenna

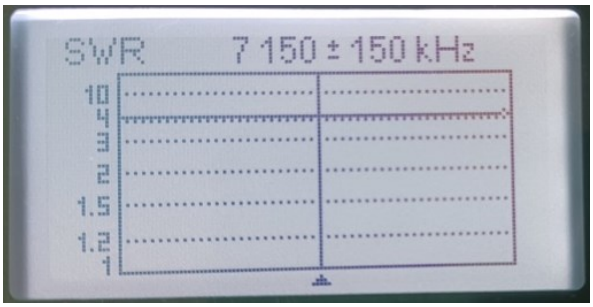
Secure the center dogbone insulator and a paracord guy wire to the fishing pole, then erect the pole. Secure the end dogbone insulator to a tree or other tall structure. Connect the coax between your transceiver and the unun. Drive the ground stake almost all the way into the dirt.

To first test the inverted-L Rybakov antenna, I wanted to play around with the height and the tuning, without worrying about the flimsiness of the fiberglass pole. So, I set up two 28-foot military masts fifty feet apart on my front lawn. That gave the antenna plenty of isolation from the metal, yet allowed for the 26 feet of height.

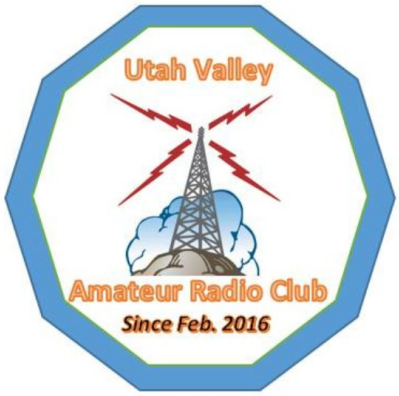
The antenna tuned really well on 15 meters, 20 meters, and 80 meters, but not so well on 40 meters. I tried modifying the tuning and matching by adding radials, first a pair of 33-foot wires, then a pair of 66-foot wires, then both. I discovered that the more radials I added, the worse became the tuning, and they didn't seem to help with performance. My antenna seemed to work best with no radials at all. Here are some analyzer results:



80 meters with a wide bandwidth



Disappointing 40 meters



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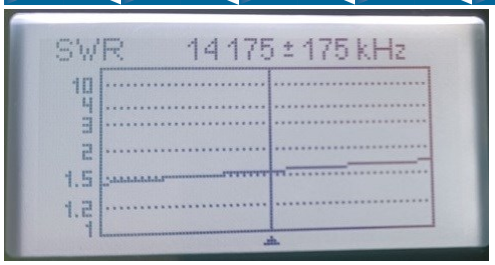
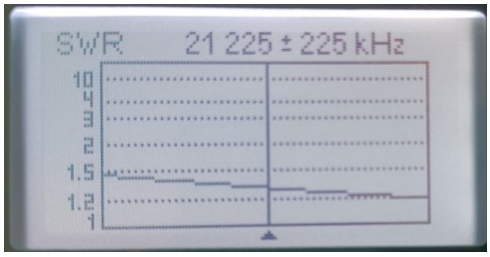
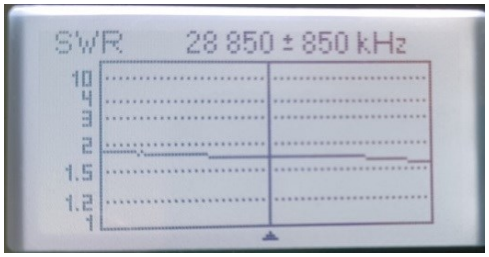
Inverted-L Rybakov antenna



20 meters



15 meters



10 meters

I connected the coax between the antenna and my Icom IC-718, and right away I noticed that this was a terrific *receive antenna*. It was able to bring in a lot of signals on 20 meters and 40 meters, which were the most active bands on the night I finished constructing the antenna. Even 40 meters tuned easily with my external tuner. I didn't have room to show them here, but the analyzer also displayed good SWR response on 6 meters, 12 meters, and surprisingly, 2 meters!

While listening around, testing on 20 meters, I heard a loud, clear signal whose operator spoke with an accent, so I attempted to make a contact, in spite of the pileups. It was a guy named Adrian TI7ØRC from Costa Rica, and it took three attempts, but he finally acknowledged my call sign, so he became my first contact with my inverted-L Rybakov antenna. (BTW, Adrian confirmed the contact on QRZ a week later.)

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